6 Choosing which transformational change characteristics to assess

This chapter provides a framework to understand transformational change characteristics. It outlines the steps and methodology to choose transformational change characteristics relevant to a policy. Identifying the phase of transformation provides an understanding of the starting situation – that is, the context in which the policy is implemented. This helps users to describe the historical background and the possible future pathway towards the vision for transformational change, as described by the user. Identifying barriers to transitioning the system that are specific to the phase of transformation is useful when choosing which transformational characteristics to assess.

Checklist of key recommendations

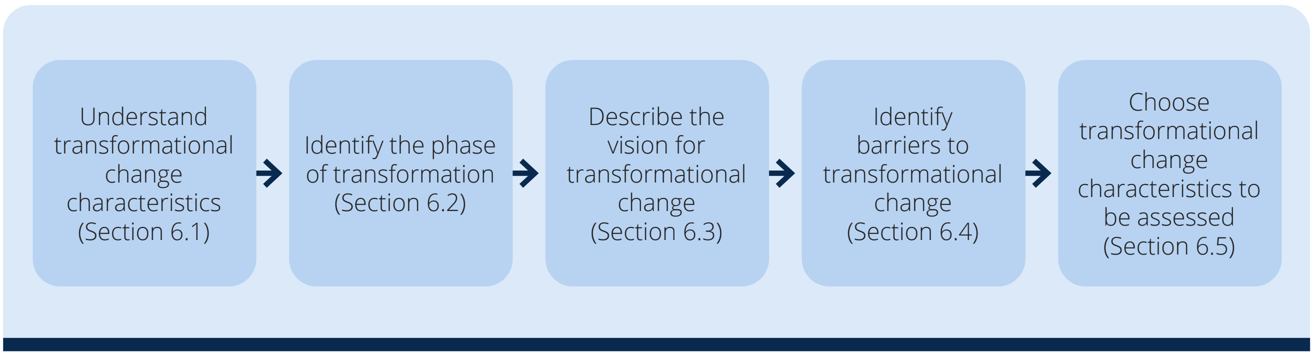
- Identify the phase of transformation to understand the context in which the policy is being planned or implemented
- Describe the transformational vision of the policy, through consultation with key stakeholders
- Identify barriers to transformational change specific to the phase of transformation of the economy in which the policy is operating
- Choose characteristics to be assessed based on their relevance to transformational change in the context of the policy and the society in which it is implemented
- Describe outcome and process characteristics relevant to the policy

6.1 Understand transformational change characteristics

This section explains characteristics of transformational change to help users understand the transformational impacts of a policy that are consistent with the definition given in Section 3.2. The climate and sustainable development goals included in the definition of transformational change indicate the desired direction and magnitude of

FIGURE **6.1**

Overview of steps in the chapter



change that are required to tackle climate change and sustainability transition at any level of society. The characteristics provide a generic framework to describe all transformational aspects of a policy. The methodology helps users analyse a policy's potential to fundamentally change systems and contribute to global goals over the long term. However, it is recognized that aligning individual policies with global goals can be done in multiple ways and there is no one "right way" or method to do so. One approach is downscaling of the global goals to a country, sector, company or other level, as explained in Box 3.2.

Figure 6.2 shows a framework of characteristics of transformational impact. There are two types of impacts: outcomes and processes. Within each type there are categories; within each category, there are characteristics. Together, the outcome and process impacts are used to determine the extent to which a policy is transformational within a given system. In later chapters, all policies are assessed against the framework of characteristics of transformational impact.

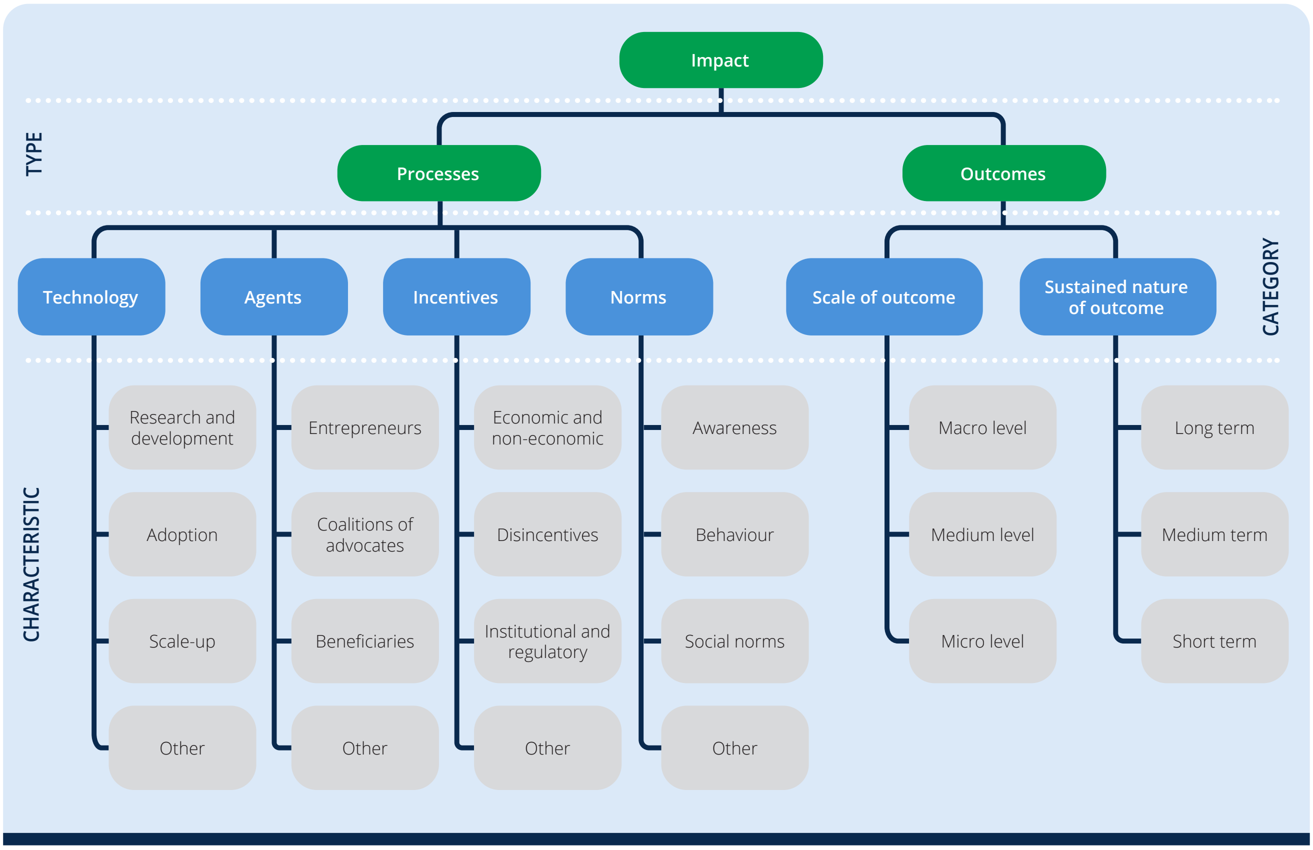
6.1.1 Outcome characteristics

Outcome characteristics refer to the scale and sustained nature of outcomes resulting from a policy. Outcomes are measured in terms of GHG emissions reductions and selected sustainable development impacts across environmental, social and economic dimensions (e.g. air quality, health, jobs, gender equality, energy security). Users assess both the scale and the sustained nature of selected impacts of the policy on GHGs and sustainable development.

The scale of outcomes is a combination of the magnitude (size) of impacts and how widespread they are. Making a policy more transformational involves enhancing the ambition of the policy from small-scale to large-scale outcomes, as well as affecting a greater population. Although the

FIGURE **6.2**

Characteristics of transformational impact



focus is on large-scale changes, it is important to note that many multi-level small-scale changes can collectively lead to large-scale changes, and a single small-scale change can trigger a large-scale change over time. What constitutes "large" depends on the context, including the role and share of the economy or sector that the policy contributes towards for alignment with global goals. For example, even though large emissions reductions at a sectoral level can be considerably smaller than what would be considered large at a national level, the level of reduction may be transformational for the chosen sector.

To assess the magnitude of impacts, users can refer to the ICAT GHG methodology documents (for assessing GHG impacts) and the ICAT *Sustainable Development Methodology* (for assessing the magnitude of sustainable development impacts; in particular, see Chapter 7 for a qualitative approach to classifying impacts as major, moderate or minor; and Chapters 8–10 for methodology on quantifying impacts).

This methodology acknowledges that several policies may contribute to system-level changes. For example, land-use policies relating to agricultural productivity and sustainability, or to strengthening indigenous land rights, may reduce pressure on forests and bring down deforestation rates. This may contribute to GHG reductions from the land sector and sustained land-use transition. Similarly, "just transition" and social protection policies to safeguard workers and communities are critical for sustaining transformation and ensuring smoother transition away from carbon-intensive technologies. However, these policies may not directly lead to quantifiable GHG impacts. Users should use their understanding of how the policy impacts various process characteristics (discussed below) and contributes to GHG impacts at the system level, as well as other resources (e.g. experts, literature and studies on related issues, stakeholder consultations), to inform and supplement their assumptions as they quantify GHG impacts. Proper documentation of assumptions and the underlying rationale, as well as limitations and uncertainties, will improve the credibility of the final assessment. Where applicable, users are encouraged to consult sector-specific resources (e.g. the ICAT GHG methodology documents, the *Policy and Action Standard*) for quantifying GHG impacts of policies.

Furthermore, policies may have negative as well as positive impacts on sustainable development and climate mitigation. Negative impacts may include loss of employment, transfer of jobs from one sector or subsector to another, reduced production in different sectors and loss of income, especially for fossil fuel–dependent economies such as coal and oil producers. The ICAT *Sustainable Development Methodology* helps users to assess synergies and trade-offs between multiple sustainable development impacts. Understanding and managing the negative impacts, and striking a balance across all kinds of impacts are crucial for achieving a just and sustained transformational change. The scale of transformational outcomes is assessed for climate and sustainable development through separate assessments. GHG emissions reductions are recognized as a priority to achieve a zero-carbon society.

The sustained nature of the outcomes of a policy refers to the durable nature of the effects of the policy. Making a policy transformational involves expanding support for the policy over time and preventing the removal or weakening of its transformational impacts. This helps to lock in the change and makes reversal more difficult.

Table 6.1 provides an overview of outcome characteristics. The magnitude of change at various levels of a system helps to show the scale of the outcome, while the period over which it can be sustained conveys how well entrenched the change is. These are assessed together to capture the desired ambition of the policy in the part of society targeted for change, aligned with the normative direction of change towards achievement of global goals. For example, increasing the share of natural gas in a country's energy system may produce large emissions reductions over a long time frame, and may be mistakenly considered transformational when viewed in isolation. However, increasing the natural gas share does not disrupt established high-carbon practices in the long term, although it may lead to the decline of coal. Further, it does not avoid carbon lock-in, nor does it contribute to a zero-carbon society in line with the global goals.

It should be noted that the different levels described in Table 6.1 are absolute, to enable comparison of transformational impact assessments across different contexts, if this is desired. For example, the Nitric Acid Climate Action Group initiative targets more than 500 fertilizer plants (medium level – each plant is assessed in a national context) globally (macro level – the aggregated impact of all plants is likely to have a global impact) to abate nitrous oxide (N_2O) emissions from the sector (transformational impacts are possible at both macro and medium levels).

TABLE **6.1**

Outcome categories and characteristics of transformational change

Category	Characteristics	Description
Scale of outcome	Macro level	GHG outcome is large in magnitude at international/global level. Sustainable development outcome is net positive in magnitude at international/global level.
	Medium level	GHG outcome is large in magnitude at national or sectoral levels. Sustainable development outcome is net positive in magnitude at national or sectoral levels.
	Micro level	GHG outcome is large in magnitude at subnational, subsector, city or local levels. Sustainable development outcome is net positive in magnitude at subnational, subsector, city or local levels.
Time frame over which outcome is sustained	Long term	GHG outcome is achieved and sustained for ≥15 years from the starting situation. Sustainable development outcome is achieved and sustained for ≥15 years from the starting situation.
	Medium term	GHG outcome is achieved and sustained for ≥5 years and <15 years from the starting situation. Sustainable development outcome is achieved and sustained for ≥5 years and <15 years from the starting situation.
	Short term	GHG outcome is achieved and sustained for <5 years from the starting situation. Sustainable development outcome is achieved and sustained for <5 years from the starting situation.

6.1.2 Process characteristics

Process characteristics describe how a policy can drive changes in systems that enable achievement of transformational impacts. These can be understood as intermediate steps or means to realize transformational outcomes. For example, a combination of regulatory processes, financial incentives, research and development coalitions, entrepreneurs and incubators likely need to work in concert to enhance adoption and diffusion of disruptive, clean technologies to cause systemic shifts in society. The methodology brings these underlying drivers of system change together in the form of process characteristics that are organized into four categories (in no particular order of importance): technology, agents of change, incentives and norms. In Section 6.5, users will choose process characteristics relevant to their assessment.

Table 6.2 provides an overview of transformational process characteristics. The categories can be interpreted broadly with accompanying rationale and justification. For instance, for the transport sector, issues involving (re)design of urban spaces (e.g. compact cities, multi-use spaces, walkable/bikeable design) can be captured under "technology" because this category refers to technologies, practices, techniques, skills, processes and methods. Similarly, sustainable agriculture practices and methods to enhance agricultural productivity can also be considered in this category. Users can also add "Other" characteristics to each category if the policy triggers changes society that are not captured in this table (as shown in Figure 6.2).

TABLE **6.2**

Process categories and characteristics of transformational change of systems

Category	Characteristics	Description
Technology (technologies, practices, techniques, skills, processes and methods)	**Research and development (R&D):** Policy supports R&D for building technological capabilities favouring a low-carbon economy.	Technological research and development happens through support of science, innovation, specialization and learning. Investment in R&D, development of the knowledge/skill base, research networks and consortiums, capacity-building efforts, and experimentation are examples of activities supporting technological development.
	Adoption: Policy leads to early adoption of promising low-carbon technologies.	Technology adoption can be facilitated by pilot projects, demonstrations, experimentation, and publicly or privately funded trials of low-carbon technologies. This helps in assessing the market for new technologies, developing skills and capacities to use them, and building networks to support new solutions. It can be understood as the initial phase when an entity first gains knowledge of, develops an understanding or opinion about, experiments with or rejects an innovation.
	Scale-up: Policy supports scale-up and diffusion of low-carbon innovations.	Technology scale-up can be facilitated by replication, diffusion through public–private sector networks, training workshops, business forums, and application of innovative ways to conduct business and deliver products and services at a larger, more widespread scale.
Agents of change	**Entrepreneurs:** Policy promotes entrepreneurs, businesses and investors to catalyse transformational change.	Actors, such as entrepreneurs innovating and experimenting with new technologies and applications, businesses forming markets, and investors bringing resources to clean technology, are key agents of change that the policy can support to drive change. Entrepreneurship can be supported by providing an enabling environment to use initiative and take risks, and by facilitating exchange of information and ideas.
	Coalitions of advocates: Policy supports coalitions and networks that seek to broaden and deepen support for low-carbon development.	The agency of a wide range of stakeholders, including those that can provide checks and balances on those representing entrenched interests, can be exercised through political mobilization, coalitions, lobbying strategies and engagement in advocacy. New networks of various types of actors (e.g. labour and environmental movements, private–public actors, political and civil society organizations) may come together because of the way the policy was designed.
	Beneficiaries: Policy supports diverse groups of society affected by the transformational change, which subsequently support the policy.	Beneficiaries include those who benefit directly from the policy (e.g. solar producers) and those who are compensated if the policy has adverse effects (e.g. workers employed in the coal industry who lose their jobs). Beneficiaries can serve as agents of change, and play a role in ensuring that the policy is durable and strengthened over time.

TABLE **6.2,** continued

Process categories and characteristics of transformational change of systems

Category	Characteristics	Description
Incentives (incentives, institutions, regulations)	**Economic and non-economic:** Policy uses fiscal and non-monetary incentives to shift technology and increase market penetration.	Economic incentives include tariff structures, access to low-cost finance, feed-in tariff policies for renewable energy, value-added tax (VAT) exemption, import duty exemptions on new technology, and lowered land rates on renewable energy projects. Non-economic incentives include partnerships, transitional support to communities affected by phase-out of emissions-intensive activities (e.g. alternative employment, training), giving ownership to local initiatives and communities, long-term institutional and governance support, political power and support for transition, signing memoranda of understanding, and removing bureaucratic procedures.
	Disincentives: Policy de-incentivizes technologies and businesses contributing to a high-carbon economy.	Disincentives include taxes on carbon-intensive products, use of market-based instruments such as import duties, tariff structures that discourage investments in business-as-usual technologies, reduction or phase-out of fossil fuel subsidies, and increased or new fossil fuel taxes.
	Institutional and regulatory: Policy creates or reconfigures existing conditions, including availability of finance for implementation, and puts in place regulation and institutions favouring low-carbon development.	The policy leads to fertile ground for further institutional or regulatory change by the government. For example, a climate policy may lead to the creation of formal and informal institutions, or new regulations over time, or may create a steady budgetary allocation for policy implementation. The policy may also lead to development of intragovernmental processes for horizontal integration (e.g. interministerial coordination bodies) or multi-scale governmental processes facilitating vertical integration (e.g. national–state–local coordination entities).
Norms	**Awareness:** Policy supports awareness-raising and education for sustainability transition.	This includes raising awareness to increase support for low-carbon solutions to effect a change in norms and behaviour among diverse groups of stakeholders. Examples include awareness campaigns and sensitization of policymakers and consumers (e.g. to inform policymakers about falling prices of renewable energy technologies, to enable consumers to easily identify more efficient appliances through labelling programmes), addressing barriers to adopting new behaviours, disseminating information at various levels of governance, and using local organizations and media to spread information.
	Behaviour: Policy supports measures that discourage high-carbon lifestyle and practices, and promote low-carbon solutions.	Measures focused on influencing consumer behaviour include peak energy savings, credit provided by utilities, cash incentives for using alternative transport modes, congestion charges for driving in certain areas during busy hours, and rewarding recycling or use of public transport.
	Social norms: Policy affects norms within society that align with, and further promote, low-carbon, sustainable development.	Social norms refer to cultural rules of behaviour that are considered acceptable in a society. As awareness increases and behaviour changes, societal norms change. The policy contributes to a low-carbon lifestyle becoming the prevalent societal norm, which reflects broad and deeply entrenched support within society. Such impacts may change how natural resources are valued, encourage willingness to pay for pollution, or influence social norms relating to household energy consumption or sustainable behaviour in general.

Appendix A provides examples of indicators for process and outcome characteristics, largely applying to the energy sector, for a more detailed qualitative and quantitative description of characteristics.

Process characteristics help with understanding changes occurring beyond the policy level and are applicable to policies in any sector. The methodology asks users to consider these policies within a broader context (Sections 6.2–6.4) and investigate whether they have an impact at a system level (e.g. energy system, transport system). This is done by identifying the impacts of policies on process characteristics that are considered relevant for transformational change (Section 6.5). Users are encouraged to think beyond the direct policy impacts and look for likely pathways of change in individual process characteristics that the policy could trigger. Changes in process characteristics – the drivers of transformational change – represent changes at a system level. For example, "just transition" policies focused on economic revitalization, worker (re)training, social protection for affected communities, and so on, may not directly target technology scale-up. Traditionally, monitoring of such policies will not include indicators related to scale-up. But, when assessing such policies for their transformational impacts, if technological scale-up is identified as relevant for transformational change in a given context, the system-oriented approach described here challenges users to unpack how their "just transition" policy may contribute to scale-up. If there is no such impact, this approach provides an opportunity to modify the policy design so that it can contribute to transformational change.

This is not meant to be an exact mathematical, highly quantitative methodology. Instead, it should be seen as a thought exercise to challenge policymakers to design policies that help realize a transformational vision.

6.2 Identify the phase of transformation

Comprehensively assessing the phase of transformation of the economy in which the policy is operating is a critical step in understanding whether the policy is well suited to overcoming barriers and driving transformational change. The phase of transformation refers to the economic, social, institutional and political context in which the policy is being planned or implemented. This contextual understanding is important, to enable users to choose and assess process and outcome characteristics in subsequent steps. Different components of the system can be at different stages of transformation towards zero-carbon development. For example, although low-carbon regulation may be in place, institutional capacity to implement it may be lacking; although low-carbon technological solutions may exist, consumer demand to scale up these solutions may be too weak.

Figure 6.3 shows a framework for assessing and visualizing the current status of a system that is on a pathway of transformation towards zero-carbon and sustainable development. It helps answer the question "Where are we today and where are we heading?"

A system undergoing transformation to zero-carbon and sustainable development can be described as being in any of the following four phases.

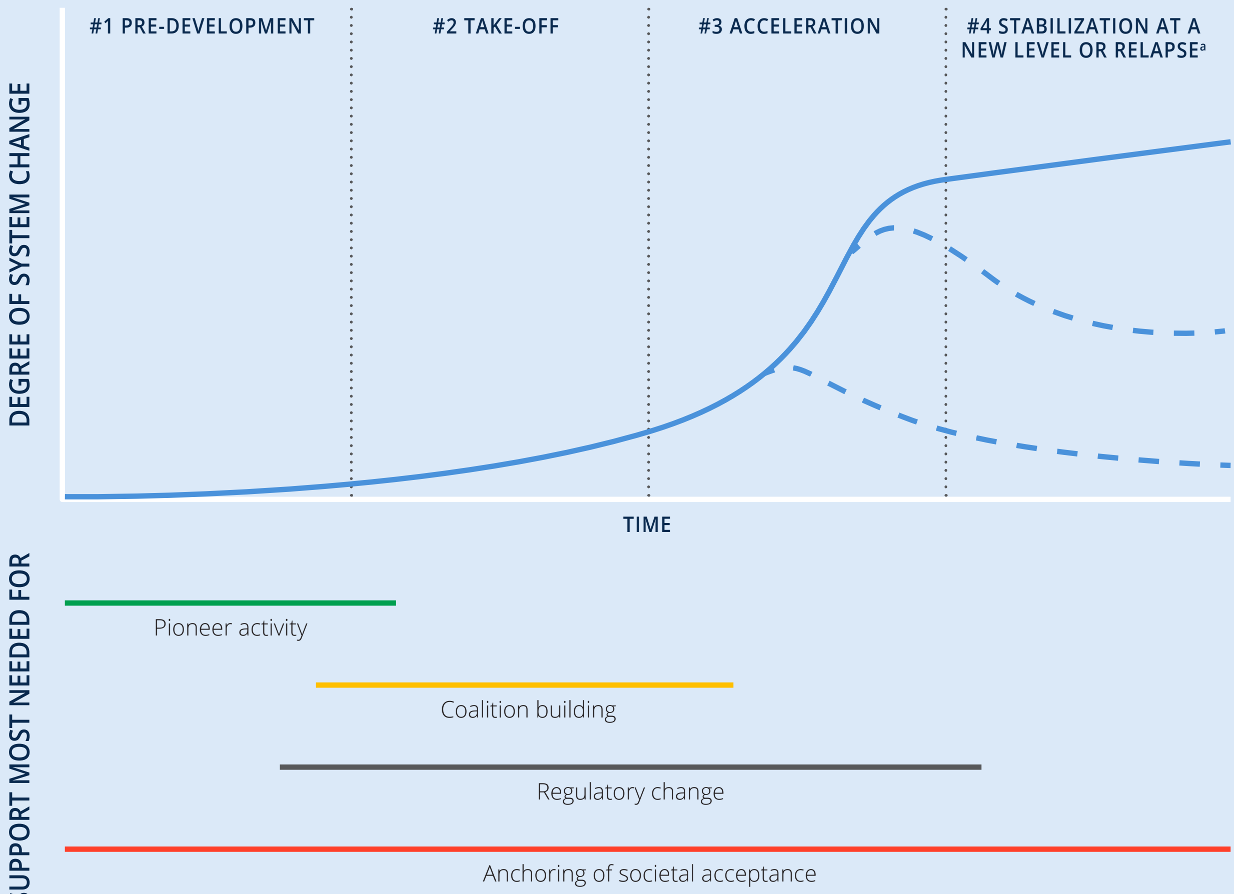
Pre-development
The pre-development phase could be described as the comfort zone phase. This is characterized, on the one hand, by visible and increasing pressure on government, and policies to make moves towards low-carbon and sustainable development. Often, such pressure is generated externally and/or from local civil society. On the other hand, the pre-development stage is also characterized by stability and the status quo, in which existing or predominant paradigms are rarely challenged, and institutions are stagnant, or very few attempts are made to change them.

Take-off
The take-off phase is characterized by observable moves to change the system towards more openness and acceptance of new ideas and concepts that question or challenge existing high-carbon paradigms. There is an increasing awareness of problems and issues relating to unsustainable development and concrete attempts to devise possible solutions. Experimentation, innovation and alternatives are expanding and gaining momentum. However, there is still no consensus or common understanding about suitable solutions. Lobbying against the new and alternative solutions remains strong, fuelled by current regime elites who benefit from the existing system.

Acceleration
In the acceleration phase, new solutions or innovations gain momentum and challenge the status quo. Alternative solutions have become widespread, and are accepted and acknowledged. Despite the opposition by interests that profit from the high-carbon status quo, change is accelerating towards visible and concrete transformative low-carbon solutions for society and the economy.

FIGURE **6.3**

Phases of transformation



Source: Mersmann et al. (2014a), adapted from Rotmans et al. (2001).

[a] Dotted lines represent alternative scenarios of relapse.

Stabilization or relapse

In the stabilization phase, the system is fully transformed, and the new pathways are embraced broadly in society and the economy. Consequently, the rhythm and speed of change decrease significantly, as people start taking the new situation for granted. However, the risk of relapse is high if the interests of the high-carbon regime remain active, and continual efforts may be needed to maintain momentum.

It is a *key recommendation* to identify the phase of transformation to understand the context in which the policy is being planned or implemented. This can help users to understand the starting situation, the main barriers to transformation and the context for the vision statement. Figure 6.4 can be used to identify the phase of the system at the starting situation. Box 6.1 illustrates various phases of transformation in a society, using a case study of how wind power development in Denmark has transformed the electricity production system.

FIGURE **6.4**

Criteria to identify the phase of transformation for a system

Phase	Criteria
Pre-development	• Existence of pressure coming from local civil society or other actors • Little or no questioning or challenging of existing paradigms; lack of open debate, and general level of awareness and mobilization is weak or low • Visible signs of unsustainable development, but lack of or low collective awareness or action to embrace new pathways • Solutions proposed to solve social and economic problems continue to follow predominant paradigms
Take-off	• Significant increase of pressure for new solutions and change • Innovations and new paradigms are integrated and promoted (i.e. experiments gain importance and become widespread and visible) • There is general optimism that new solutions and pathways are feasible and realistic • Disagreement exists among parties on which options are the most suitable to address the problems • Open competition for innovation is not yet promoted • Business models that favour low-carbon pathways are not yet predominant • Strong resistance from those benefiting from the existing paradigms is common
Acceleration	• Innovations and new solutions openly challenge and start pushing away established paradigms • Innovations and new solutions are widely accepted and spreading • The speed of change has increased significantly and is accelerating; existing paradigms are feeling the pressure to embrace innovation and new pathways or run the risk of being outpaced and pushed aside • Systemic changes are happening, with visible interconnected dynamics between technological, economic, institutional and social changes
Stabilization or relapse	• Nearly all barriers to innovation and transformational change have been overcome • New pathways and models may now have been widely adopted and accepted, and may have become the new model or dominant state • The rate and magnitude of change and innovation have stabilized, resulting from the adoption and integration of new social and economic norms • There may no longer be a visible risk of relapsing back to the old state of unsustainability and remaining locked into a high-carbon development model

BOX **6.1**

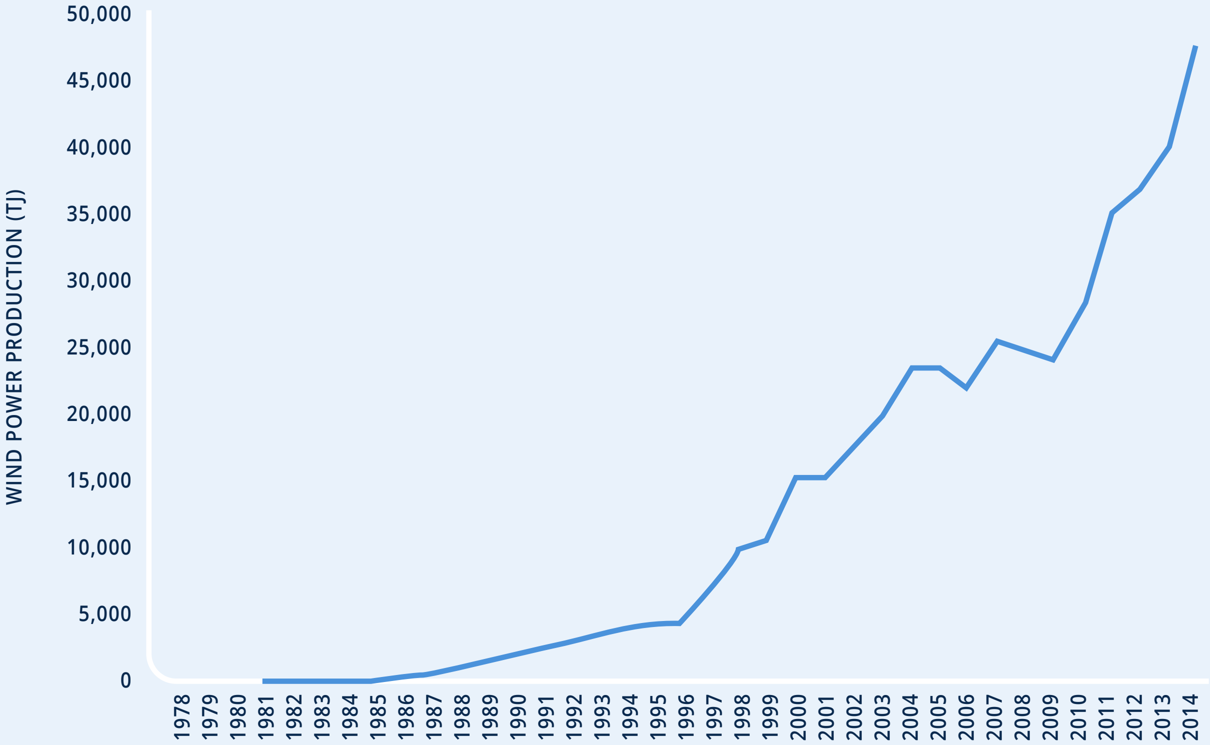
Wind power development in Denmark

The story of the Danish transformation of the electricity production system begins in the pre-development phase. A pioneer schoolteacher and meteorologist, Poul la Cour, built the first electricity-producing windmill in 1891. Before this, windmills in Denmark had been used to grind flour and pump water. For many decades, the political and economic interest in electricity production from windmills remained low, mainly driven by pioneer and research activities.

In the 1970s, the global oil crisis was felt. Denmark's dependency on oil-producing countries, fluctuations in oil prices and growing environmental awareness resulted in an increased interest in wind power development. Nuclear energy and renewable energy were widely debated as two alternative energy sources. An opposition movement to nuclear power grew strong, informing Danes about the risks of accidents, nuclear waste and misuse of nuclear fuel in conflict situations. With this backdrop, societal support for wind power development grew in the take-off phase (see Figure 6.5).

FIGURE **6.5**

Rise of wind power in Denmark



The acceleration phase for wind power development in Denmark started in the 1990s and is ongoing. Broad societal acceptance and favourable political interest, followed by legal interventions and economic subsidies, characterize the acceleration phase. The share of electricity generated from wind was almost 50% of the total electricity generated in Denmark in 2018.[16] Increasingly, wind power in Denmark is replacing fossil fuel–based electricity production.

The stabilization phase is expected to be achieved by 2050 when the Danish electricity production system is projected to become zero carbon.

Source: Pedersen (2015).

[16] REN21 (2019).

6.3 Describe the vision for transformational change of the policy

Transformational change can occur as a result of pressures created by people, policies or new disruptive technologies at different levels of society. Such pressures may enable a reconfiguration of existing structures, policies and practices. A policy can contribute to transformational change by reconfiguring high-carbon and unsustainable structures in society through intervention(s) at one or several interacting societal levels.

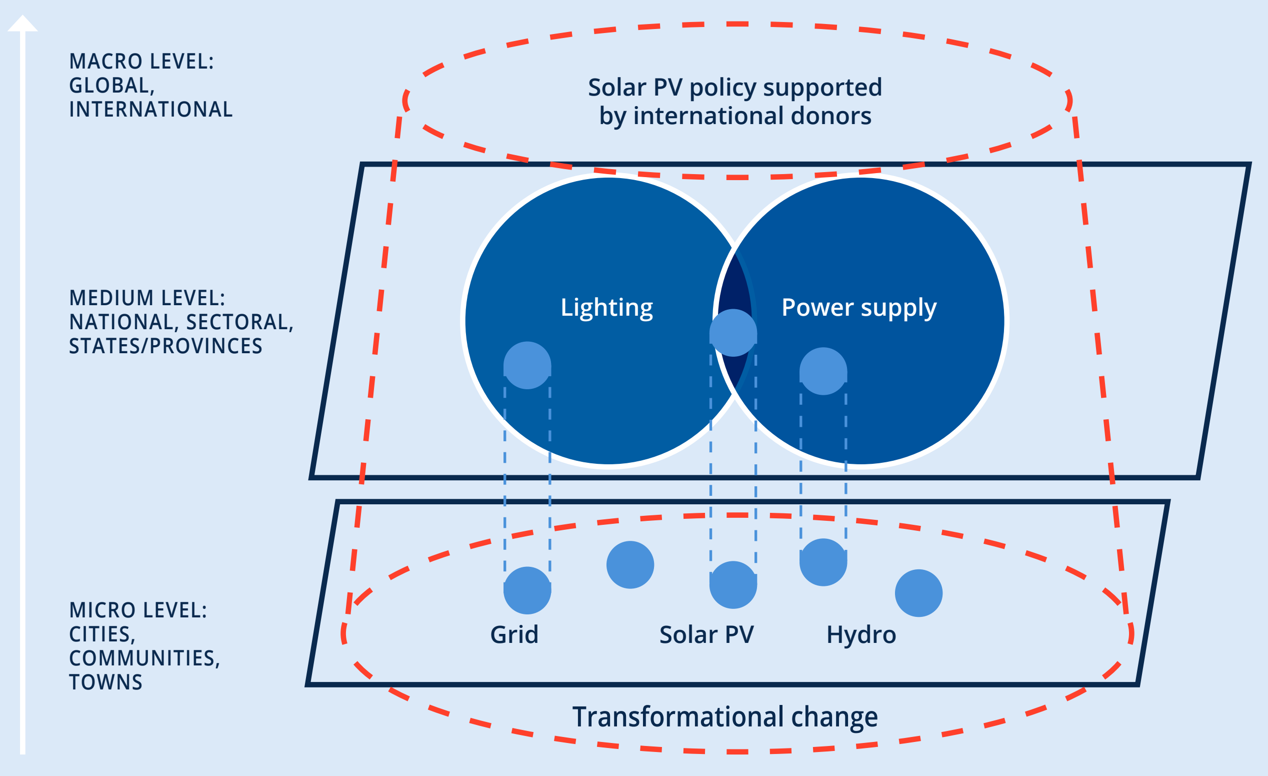
Figure 6.6 illustrates how the hypothetical solar PV policy contributes to changes at multiple levels. The policy, which is supported by international donors (macro level), is envisaged to create change in national policies for lighting and power supply (medium level), and in towns and local areas (micro level) by promoting solar PV systems and grid connection.

It is a *key recommendation* to describe the transformational vision of the policy, through consultation with key stakeholders. To identify how a policy seeks to change society towards zero-carbon and sustainable practices, it is useful to describe the vision for transformational change over time. Users are encouraged to describe the vision for transformation as moving from where the system is currently (i.e. the existing phase of transformation, as identified above) to where it should be to achieve the transformational shift desired. Table 6.3 provides a template for describing the vision for transformational change. Box 6.2 provides an example from Costa Rica of describing a vision for transformational change.

The description of a vision for transformational change helps to understand the ambition of a policy for contributing to zero-carbon and sustainable development goals. Scale and time aspects are defining characteristics of transformational change.

FIGURE **6.6**

Example of how a solar PV policy interacts with society at multiple levels



Source: Adapted from Geels (2004); Bodoo and Olsen (2017).

In practice, however, transformational change cannot be determined a priori or in hindsight within a short period, if the ongoing changes are truly transformational in terms of being "locked in", sustained and resulting in large-scale impacts. Monitoring of indicators (Chapter 10) helps to assess whether the transformational change process and outcomes are on track towards the vision. The description of a vision for transformational change can help guide the selection of the assessment boundary and assessment period in Section 5.3.

Involving an inclusive network of key stakeholders (e.g. 10–15 people) from all spheres of society – including both those investing in a low-carbon future and those interested in maintaining the status quo – is useful to develop the vision and obtain advice on how to achieve transformational outcomes during the transition period. Stakeholders from government, companies, NGOs and knowledge providers should be invited to form a network of experts, advisers and opinion leaders. Refer to the ICAT *Stakeholder Participation Guide* for more information on identifying and understanding stakeholders (Chapter 5), and establishing multi-stakeholder bodies (Chapter 6).

TABLE **6.3**

Description of the transformational change vision

Vision for desired societal, environmental and technical change	Example (solar PV policy)
Long term (≥15 years): Describe the long-term vision for transformational change – social, environmental and technological – including actions to be taken and impacts to be achieved in the future. Describe the vision for desired changes at different levels that are applicable in a given context – such as global, national, sectoral, provincial, cities and communities. A vision statement is not limited to what is promised by the policy. Rather, it describes the future, desired context to which the policy contributes.	Contributing to the global vision of zero-carbon and sustainable development, the desired future change is to achieve zero-carbon electricity production. The 2050 vision is to achieve 60% solar PV in the national electricity mix and create 2 million new green jobs. The policy, however, does not result in a significant change at the global level.
Medium term (≥5 years and <15 years): Describe the medium-term vision for transformational change, including actions to be taken and impacts to be achieved beyond the current planning cycle. Describe the vision for desired changes at different levels in terms of the development of coalitions, agendas and pathways that are planned to achieve the transformational vision.	The mid-term vision by 2030 is to achieve 30% solar PV in the national electricity mix and create 1 million new green jobs. In addition, the policy has set the following goals at the national/sectoral level: • annual emissions reductions of 20 million tCO_2e • 200,000 new green jobs (e.g. in solar PV installation and maintenance sectors).
Short term (<5 years): Describe the short-term vision for transformational change, including actions to be taken and impacts to be achieved immediately within the current planning cycle. Describe the vision for desired changes at different levels, and discuss how actors, political support and investments are mobilized to implement policies and actions for achieving transformation.	The short-term vision by 2022 is to install 20 GW of rooftop solar PV and create 200,000 new green jobs in doing so. The solar PV policy is implemented at subnational levels, supported by incentives for private sector involvement and knowledge development. In rural districts and towns, solar PV mini-grids enable economic growth, poverty reduction and new jobs.

BOX **6.2**

Guiding questions and example to describe a vision for transformational change

The guiding questions are informed by the Transition Management (TM) approach,[17] which views transformation as a multi-level, phased process of structural change in society. Transformational change towards a shared vision is manageable through four governance activities; strategic, tactical, operational and reflexive. Transformational change cannot be steered and controlled by a single actor or intervention. Rather, processes of change can be managed through networks of actors, coordination of actions, participatory processes of co-design and implementation, learning from experience, and iterative adjustments of the vision and the means to achieve it.

Guiding questions	Costa Rica example
Strategic governance: What is the long-term (≥15 years) vision for social, environmental and technological change?	Costa Rica has adopted a national Decarbonisation Plan to achieve a net zero carbon emissions economy by 2050, in line with the objectives of the Paris Agreement. Ten focus areas have been identified to achieve decarbonization. For each focus area, a transformational vision is stated. For example, by 2050, electric power will be a primary source of energy for transport, and for residential, commercial and industrial services, among others (Focus Area 4 of the national Decarbonisation Plan).
Tactical governance: What structures, institutions, behaviour and values need to change over a mid-term period (≥5 years and <15 years) to achieve the overall vision?	By 2030, the electrical grid is capable of operating at 100% with renewable energies (Focus Area 4). To track progress of NDC implementation to achieve the mid-term and long-term milestones in all focus areas in the context of national sustainable development goals, Costa Rica has set up a National Metrics System of Climate Change (SINAMECC). Assessment of sustainable development impacts of climate policies helps to identify benefits and negative effects, to promote synergies and minimize trade-offs under the Decarbonisation Plan.
Operational governance: Which actions and projects within the short term (<5 years) enable the desired change?	ICAT supports Costa Rica to develop SINAMECC in implementing the ambitious climate targets in a transparent and evidence-based manner. Costa Rica is using the ICAT *Sustainable Development Methodology* and the ICAT *Transformational Change Methodology* to lay the foundation for policies that drive the transformation to a net zero carbon society and support national and global sustainable development goals.
Reflexive governance: Do the assessment results lead to new insights and knowledge to revise and adjust the vision for transformational change?	Results of the transformational impact assessment inform the design and implementation of NDC policies specific to each sector or subsector. Insights from the assessment on the processes and outcomes of change may lead to revised vision statements for sectors or subsectors.

Source: Informed by Loorbach (2010); Mersmann et al. (2014b); Government of Costa Rica (2018).

6.4 Identify barriers to transformational change

Analysis of barriers is important for the assessment of transformational change. If different types of barriers are not taken into account, the policy could be less effective than envisaged. Users who consider all relevant barriers to the policy are better prepared to overcome resistance and make use of opportunities that arise. An understanding of barriers helps with choosing relevant process characteristics in Section 6.5. It is a *key recommendation* to identify barriers to

[17] Loorbach (2010).

transformational change specific to the phase of transformation of the economy in which the policy is operating.

A barrier adversely affects the achievement of a target.[18] It is an obstacle to reaching the full mitigation potential of a system, which can be overcome by designing and enacting measures to prevent the undesired effect.[19] Barriers can either hinder desired effects or lead to undesired effects. The removal of barriers can itself be a mitigation measure (e.g. removal of fossil fuel subsidies).

A careful and comprehensive barrier analysis is therefore essential to achieve any change, including transformational change. Stakeholders can help to identify barriers. For information on designing and conducting consultations, refer to the ICAT *Stakeholder Participation Guide* (Chapter 8).

Barriers can be categorized in different ways. Categorization can help to ensure that all relevant issues are covered by the analysis. Barriers include:

- **political barriers** – opposition to change due to ideological, financial or other interests; lack of commitment to find solutions to the challenges of climate change; power struggles between the losers and winners of transformational change
- **institutional and regulatory barriers** – prevalence of institutions and laws that help maintain the status quo; resistance to new institutional arrangements and regulations; lack of risk cover instruments; existence of incentives that favour carbon-intensive modes of production; non-existent, unclear, complicated or conflicting policies and regulations (e.g. permitting procedures that are lengthy and expensive); overlapping responsibilities across multiple institutions; lack of coordination between national and subnational agencies
- **social barriers** – lack of awareness of low-carbon options, benefits and opportunities; reluctance to accept the introduction of low-carbon technologies, especially when replacing conventional technologies; lack of demand for low-carbon options; lack of social acceptance and trust in equitable distribution of benefits from mitigation projects; lack of local empowerment to make decisions that favour a low-carbon economy
- **technology barriers** – dependence on import of low-carbon technologies; lack of domestic production facilities or insistence on domestic sourcing of technology; low quality of available technology; lack of availability of equipment for production and maintenance
- **capacity constraints** – lack of trained personnel for production, installation and maintenance of low-carbon technologies, policies and practices; lack of trained personnel for development of own technology; lack of information on available options; lack of capacity to design and operate sustainable financial frameworks; absence of, or insufficiently resourced, institutions (e.g. for regulation, data collection or enforcement)
- **financial and investment constraints** – lack of financing and investment availability, or high cost for financing low-carbon technologies; locked-in investment in high-carbon technologies and practices; lack of risk cover instruments; existence of counterproductive subsidies or import regulation.

Users should describe the barriers relevant to the policy, considering the six categories above, and identify the characteristics affected. A single barrier may impact several characteristics, and a single characteristic may be affected by several barriers. Table 6.4 provides an example of identifying barriers for the hypothetical solar PV policy.

6.5 Choose transformational change characteristics to be assessed

This section explains how to choose transformational change characteristics to be assessed in greater detail in subsequent steps. It also explains how to describe process and outcome characteristics specifically for the policy.

The relevance of process characteristics is determined based on the objectives of the assessment, national circumstances, the phase of transformation, barriers and stakeholder priorities. It is a *key recommendation* to choose characteristics to be assessed based on their relevance to transformational change in the context of the policy and the society in which it is implemented. It is also

[18] Nygaard and Hansen (2015).

[19] Halsnæs et al. (2007).

TABLE **6.4**

Template for describing identified barriers and affected characteristics (using hypothetical solar PV policy example)

Barrier	Explanation	Characteristics affected	Barrier directly targeted by the policy
Lack of popular support and political will to promote a transition	Vested interests in existing coal- and oil-dependent production actively resist climate policies and regulations. The scale of subsidies to fossil fuels is greater than those to renewables, and political power is held by those with strong interests in maintaining current subsidy levels.	Economic and non-economic incentives	Yes
Lack of a strategy to discourage fossil fuel–based energy	Existing or foreseeable energy strategy dominantly envisages expansion of coal-fired generation capacity and only limited expansion of solar PV. A comprehensive strategy that integrates renewable resources is lacking.	Institutional and regulatory changes	No
Challenges related to grid interconnectivity	Grid integration and energy storage are among the biggest technical, institutional and economic challenges to scaling up rooftop solar PV in the country.	Scale-up	No
Lack of technical personnel for installation and maintenance	Lack of trained technicians for solar PV installation and maintenance slows down a potential scale-up of PV technology.	Scale-up	No
High upfront financial investment needed for solar PV	Lack of financial instruments to support customers in financing solar PV impedes the growth of private market and entrepreneurs in this field.	Entrepreneurs	Yes

a *key recommendation* to describe outcome and process characteristics relevant to the policy.

Characteristics are classified as "relevant", "possibly relevant" or "not relevant", as shown in Table 6.5.

For example, if the solar PV policy is implemented in a country where awareness of solar solutions is not a limiting factor to scaling up solar, the "awareness" characteristic can be considered not relevant in the assessment. However, where lack of awareness is one of the reasons for slow uptake of solar, this process characteristic should be considered relevant, irrespective of whether the policy is directed at improving awareness. Although all solar policies are not expected to address every aspect of the sector, a transformational policy is expected to consider how and when to influence relevant process characteristics to bring about systemic, lasting change. Further, the policy need not directly address all relevant process characteristics through various measures, but may envisage an indirect impact over time (e.g. subsidies lead to increased penetration of solar technologies, which in turn enhances awareness). This broader interpretation of relevance ensures that changes relating to process characteristics that are critical for transformational change in the given context are regularly monitored.

Process characteristics classified as relevant and possibly relevant are assessed in subsequent steps.

Relevant process characteristics are identified by seeking a wide range of stakeholder opinions and

TABLE **6.5**

Determining the relevance of process characteristics

Relevance	Description
Relevant	Reason to believe that a characteristic is important for transformational change in the context of the policy.
Possibly relevant	Not clear whether the characteristic is important for transformational change in the context of the policy. Where the relevance is unknown or cannot be determined, the characteristic should be monitored over time.
Not relevant	Reason to believe that the characteristic is not important for transformational change in the context of the policy.

priorities. The ICAT *Stakeholder Participation Guide* (Chapter 8) provides information on designing and conducting consultations.

The relevance of process characteristics can vary over time, as a result of changes in underlying conditions and circumstances. Users may find that process characteristics described as possibly relevant or not relevant become relevant over time, or that some process characteristics become no longer relevant. Therefore, users are encouraged to revisit the relevance of process characteristics regularly during the monitoring phase. This involves revisiting Table 6.6 and updating it at regular intervals, as per the monitoring plan described in Chapter 10. Users can also choose to monitor process characteristics classified as not relevant in less detail. Expert judgment, literature review, proxy data or stakeholder inputs can be used to identify any changes in these characteristics.

Users should describe all characteristics of outcomes and processes relevant to the policy. It is important to clearly describe characteristics in such a way that they are mutually exclusive and collectively comprehensive, while recognizing that they are interrelated. This will avoid duplication and overlaps between different characteristics, and will ensure that a particular effect is not considered multiple times during the assessment.

Table 6.6 provides a template to describe which process characteristics are selected as relevant or possibly relevant for detailed analysis in subsequent steps of the impact assessment, and to justify the choice. For completeness, transparency and reflection on ambition, users should provide rationale and justification for the choice of process characteristics included in, or excluded from, the assessment. In justifying their choice, users can describe the existing context and prevailing hindering factors that make a characteristic relevant or not relevant.

Table 6.7 provides a template to describe outcome characteristics. Users should describe outcome characteristics for GHG and selected sustainable development impacts separately, so that they can assess each individually.

Users should include all relevant transformational impacts in the assessment boundary and the assessment period. Outcome or process characteristics referring to levels or time periods that are outside the assessment boundary or period should not be included. However, to ensure a comprehensive approach to the assessment of all transformational impacts relevant to the policy, users should revisit and update the definition of the assessment boundaries in Section 5.3, as needed.

TABLE **6.6**

Template for choosing process characteristics relevant to a policy (using solar PV policy example)

Category	Process characteristic	Characteristic (specific to policy)	Relevant/possibly relevant/not relevant, and justification
Technology	Research and development (R&D)	The policy leads to increased R&D investment in the country that would enhance the uptake of solar power.	Relevant R&D efforts are needed for developing cost-effective energy storage options and to achieve better grid interconnectivity that will support more solar PV in the distribution system.
	Adoption	The policy leads to early adoption of solar grid rooftop among residential, commercial, industrial, institutional and other consumers.	Relevant Adoption rate for solar grid rooftop is quite low across the country and needs targeted interventions. High capital cost of rooftop systems and longer payback periods have discouraged their widespread adoption by small consumers in various sectors.
	Scale-up	The policy leads to large-scale deployment of rooftop solar PV installations as new business models emerge for service and delivery to capitalize on the policy incentives and preferential tariff.	Relevant Rooftop solar has a negligible share in the solar energy sector. There is a huge amount of untapped potential in the solar-rich country. Several barriers exist to large-scale deployment of rooftop solar PV (e.g. lack of modern flexible grids that can absorb solar power, need for a range of cost-effective storage options given the intermittent nature of solar power, lack of grid parity, lack of highly skilled workforce, high upfront cost).
Agents of change	Entrepreneurs	The policy directly engages entrepreneurs, businesses and investors through financial subsidy and feed-in tariff.	Relevant These are some of the most important change agents for the solar PV policy in the country. There is acknowledgement that the solar sector should be able to attract private investment and lending to sustain interest from businesses and entrepreneurs, and continue to grow. The government has commissioned a study on how to create an attractive financial environment to attract large-scale investment in the sector.
	Coalitions of advocates	The policy indirectly provides a fertile ground for coalitions and networks of stakeholders to engage in the common goal of increased solar uptake.	Possibly relevant It is not clear whether this is an important constituency to catalyse transformational change in solar PV in the country. Business associations and think tanks are active in convening stakeholders and policymakers, and providing a forum to discuss issues relating to renewable energy.
	Beneficiaries	No description necessary, since this characteristic is not relevant.	Not relevant The political context in the country, with constraints on civil society organizations, makes beneficiaries an ineffective group that is not seen to play a role in scale-up. Formation of organizations such as advocacy groups, users' associations and lobbying groups is not encouraged.

TABLE **6.6,** continued

Template for choosing process characteristics relevant to a policy (using solar PV policy example)

Category	Process characteristic	Characteristic (specific to policy)	Relevant/possibly relevant/not relevant, and justification
Incentives	Economic and non-economic	The policy uses financial incentives to catalyse growth in the solar sector.	Relevant Financial subsidy and feed-in tariff are key ways to increase technology penetration and promote grid-connected rooftop solar uptake. Incentives for integrating energy storage into the distribution grid can further encourage diffusion of solar. Other economic and non-economic incentives exist to encourage uptake of off-grid solar and large solar power plants, as well as other forms of renewable energy (e.g. wind, biomass).
	Disincentives	The policy does not employ disincentives for carbon-intensive energy generation.	Possibly relevant The assessment is limited to the solar PV sector. It is not clear whether disincentives applied to fossil fuels will be strong enough to cause any impact in the solar PV sector.
	Institutional and regulatory	The policy leads to the formation of new agencies, institutions and regulations at subnational level.	Relevant Development of new agencies is needed at the subnational level to promote solar in states. Although there is a dedicated agency at the national level to promote renewable energy, there is no counterpart in states. A robust regulatory and institutional set-up to design and implement measures, enhance coordination and build capacity at all levels does not exist yet.
Norms	Awareness	No description necessary, since this characteristic is not relevant.	Not relevant There is a high level of awareness in the country, and this is not considered a hindering factor.
	Behaviour	The solar PV policy affects the behaviour of consumers to opt for solar PV.	Relevant Awareness has not led to change in behaviour, possibly because of factors relating to financing and upfront costs. This is an area that needs more attention.
	Social norms	The solar PV policy may have an influence on societal attitudes in favour of rooftop solar PV technologies.	Possibly relevant Societal norms favour less carbon-intensive lifestyles in general, and it is not clear whether norms are holding back solar PV. There is a greater push for green, clean living in urban centres as pollution increases and environmental resources are depleted.

TABLE **6.7**

Template for describing outcome characteristics for a policy (using solar PV policy example)

Category[a]	Outcome characteristic	Description (specific to policy, including status at beginning of assessment period)
Scale of outcome – GHGs	Macro level: GHG outcome is large in magnitude at international/global level.	This level is outside the assessment boundary. No description necessary.
	Medium level: GHG outcome is large in magnitude at national or sectoral levels.	The policy has set a goal of annual emissions reductions of 20 million tCO_2e nationally. The 2030 vision is to reduce emissions by 40 million tCO_2e annually. Solar PV has a 5% share in the national electricity mix in 2015.
	Micro level: GHG outcome is large in magnitude at subnational, subsector, city or local levels.	The solar PV policy is implemented at subnational levels, supported by incentives for private sector involvement and knowledge development. In two northern rural provinces of the country, solar PV contributes 20% of the electricity mix in 2015.
Scale of outcome – sustainable development	Macro level: Sustainable development outcome is net positive in magnitude at international/global level.	This level is outside the assessment boundary. No description necessary.
	Medium level: Sustainable development outcome is net positive in magnitude at national or sectoral levels.	The solar PV policy aims to create 200,000 new green jobs in the sector (e.g. in solar PV installation and maintenance) by 2022 and up to 2 million new jobs by 2050. There are currently 10,000 jobs in the solar PV sector nationally.
	Micro level: Sustainable development outcome is net positive in magnitude at subnational, subsector, city or local levels.	In rural districts and towns, new jobs are created through installation and operation of solar PV mini-grids. In the two northern provinces, there are about 600 jobs in the solar PV industry in each province.
Time frame over which outcome is sustained – GHGs	Long term: GHG outcome is achieved and sustained for ≥15 years from the starting situation.	The period is longer than the assessment period. No description necessary.
	Medium term: GHG outcome is achieved and sustained for ≥5 years and <15 years from the starting situation.	The solar PV policy aims to achieve its mid-term (2030) vision of 30% solar PV in the national electricity mix, and sustain the trend of a growing share of solar PV in the country. Currently, solar PV has a 5% share in the national electricity mix. It is a new policy, and insufficient time has passed to clearly show that the policy impacts are sustained.
	Short term: GHG outcome is achieved and sustained for <5 years from the starting situation.	The policy aims to install 20 GW of rooftop solar PV by 2022 and trigger increased emissions reductions over the assessment period. There are no clear indications so far that the policy impacts will be sustained.

TABLE **6.7,** continued

Template for describing outcome characteristics for a policy (using solar PV policy example)

Category[a]	Outcome characteristic	Description (specific to policy, including status at beginning of assessment period)
Time frame over which outcome is sustained – sustainable development	Long term: Sustainable development outcome is achieved and sustained for ≥15 years from the starting situation.	The period is longer than the assessment period. No description necessary.
	Medium term: Sustainable development outcome is achieved and sustained for ≥5 years and <15 years from the starting situation.	The solar PV policy aims to achieve its mid-term (2030) vision of 1 million new green jobs and sustain the trend of increasing jobs in the country. It is too early to see signs of sustained job growth.
	Short-term: Sustainable development outcome is achieved and sustained for <5 years from the starting situation.	The solar PV policy aims to achieve its short-term goal of 200,000 new green jobs in the solar PV installation and maintenance sectors. There is no evidence yet that the policy's impact on jobs is sustained, although jobs are expected to show an upward trend with a rise in the share of solar PV.

[a] Users should add new rows for assessing each impact category.